REMARKS

This Amendment has been prepared in accordance with the revised amendment practice as set forth in revised 37 C.F.R §1.121 effective July 30, 2003. Reconsideration and allowance of the application are respectfully requested in light of the foregoing amendments and the following remarks.

Claims 1-22, 24-33, and 35-47 have been examined.

Claims 2, 4-5, 11-12, 14-15, 21-22, 24-25, 27-28, 32-33, 35-36, 38-40, and 43 have been amended herein.

Claims 48-54 have been added.

Claims 23, 34, 41, and 42 have been cancelled.

Applicants have amended dependent claims 2, 4-5, 12, 14-15, 22, 24-25, 27-28, 33, 35-36, 38-40, and 43 to provide antecedent basis with their respective independent claims. More specifically, these claims were amended to recite the term "electromagnetic signal," which appears in the independent claims. Applicants have also amended dependent claim 43 to depend directly from claim 32. Finally, Applicants

have amended independent claims 11 and 21 and added new claims 48-54 to further define Applicants' claimed invention.

Claim Rejections Under 35 U.S.C. §102 and §103

As a threshold matter, Applicants respectfully traverse the rejections of claims 1-10 as being unpatentable over U.S. Patent No. 4,554,836 to Rudd in view of one or more of U.S. Patent No. 5,915,050 to Russell, et al., U.S. Patent No. 6,545,762 to Lewis et al., U.S. Patent No. 4,481,825 to Kljuev, et al., 5,897,494 to Flock, et al., and U.S. Patent No. 5,495,767 to Wang, et al. Applicants respectfully submit that none of these references, taken alone or in any combination, teach or suggest each element of Applicants' claimed invention as set forth in independent claim 1 and claims 2-10 depending therefrom.

Rudd discloses a laser vibrometer. A laser beam is deflected by a Bragg cell into two beams, and the frequency of one of the beams is shifted (frequency modulated) by the Bragg cell. The shifted beam is sent to an object of interest, and the reflected signal is mixed (heterodyned) with the unshifted portion of the laser beam in a photodiode to produce a phase modulated signal the same frequency as the Bragg cell. The phase modulated signal is then demodulated to measure surface movement and velocity.

Lewis et al., discloses a method of investigating vibrations of an object by mixing laser light reflected from a vibrating object with a source of laser light, generating a signal corresponding to the interference pattern caused by the mixing of the reflected light with the source light, and analyzing this signal to remove a component of the signal that represents the bulk movement of the object using Kalman filtering techniques.

Russell, et al. discloses an optical device comprising an optical fiber directional coupler that includes a coupling region and an acousto-optic device connected to a portion of the coupling region. The acousto-optic device imparts a spatially-periodic perturbation in the coupling region. The device can be operated as a frequency shifter or optical switch.

Kljuev, et al. discloses a device for measuring vibrations, which includes a microwave generator, a waveguide system, a parabolic antenna for sending microwaves to an object of interest, and optical system for aiming the device.

Flock, et al. discloses a vibrometer for measuring vibrations of small anatomical structures, such as parts of an ear. A diode laser sends a laser beam to the anatomical structure, which produces a speckle interference pattern. The speckle interference pattern is received by the invention and processed to determine the amplitude and frequency of the vibrations generated by the anatomical structure.

Wang, et al. discloses a laser vibrometer that includes a laser beam, a beam splitter, two reflectors, an optical processor having two optical sensors, a digitizer for converting analog signal to a digital signal, a flip-flop circuit, and a counter. The device employs split laser beams to measure an object's vibrations.

Applicants respectfully submit that claims 12, 7, and 9-10, which were rejected as being anticipated by Rudd or, in the alternative, obvious over Rudd in view of Russell, et al., are patentable over these references. Both Rudd and Russell, et al., taken alone or in combination, fail to teach or suggest "an **amplitude** modulator for **amplitude modulating** an electromagnetic signal to produce an amplitude modulated signal... a receiver for receiving a reflected amplitude modulated signal from the vibrating object... and a demodulator for **demodulating the reflected amplitude modulated signal**..." as set forth in independent claim 1 and claims 2-10 depending therefrom.

As a threshold matter, Rudd, the primary reference, is wholly devoid of any teaching, suggestion, or motivation for amplitude modulating a signal prior to transmission of the signal to an object of interest. Rather, Rudd merely discloses diffracting a laser beam and shifting the frequency of a portion of the laser beam using an acousto-optic device such as a Bragg cell (*see*, e.g., col. 2, lines 51-55 ("Upon entering the Bragg cell 16 light beam A is partially deflected by the stress pattern which acts as a diffraction grating, as shown in FIG. 2. The deflected beam B is also shifted in

frequency by an amount equal to the frequency of the sonic wave")). Clearly, Rudd is unconcerned with *amplitude modulating* a signal prior to transmission to an object to be tested. Further, Rudd fails to teach or suggest receiving a reflected amplitude modulated signal from a vibrating object, and demodulating the amplitude modulated signal to extract vibration information. As such, Rudd fails to disclose each element of Applicants' claimed invention.

Russell, et al. and Lewis et al. fail to cure the deficiencies of Rudd. First, Russell, et al. relates to a field of endeavor (optical switching) that is entirely different from the present invention. As such, Russell, et al. is non-analogous art. Second, even though Russell, et al. and Lewis et al. disclose (and the Office Action suggests) that Bragg cells are capable of amplitude modulating signals, both Russell, et al. and Lewis et al. and the assertions in the Office Action fail to provide any teaching, suggestion, or motivation to employ an amplitude modulation scheme in a vibrometer. Indeed, the mere fact that a Bragg cell may be capable of amplitude modulating a signal does not, by itself, teach or suggest the use of amplitude modulation in a vibrometer. Third, even if one were to combine the teachings of Russell, et al. or and Lewis et al. with Rudd, one would still not arrive at Applicants' claimed invention. Rather, the resulting combination would be an optical vibrometer that utilizes a Bragg cell to diffract a laser beam and shift a portion of the diffracted light in frequency, but does not amplitude modulate the signal prior to transmission of the signal or demodulate a reflected amplitude modulated signal.

Fourth, even if one were to combine the Bragg cells disclosed in Russell, et al. or Lewis, et al. with the device of Rudd, it is entirely unclear that the resulting combination *would even work*. More particularly, **the photodetector 32 of Rudd is specifically configured for extracting a frequency modulated signal, not an amplitude modulated signal**. There is absolutely no indication anywhere in the disclosure of Rudd that the photodetector 32 is even capable of receiving amplitude modulated signals. As such, absent a clear showing that the photodetector 32 of Rudd would be capable of receiving and processing amplitude modulate signals, this rejection cannot stand.

Applicants submit that claims 3-6, which depend from independent claim 1 and contain all of the limitations thereof, are patentable over Rudd in view of Kljuev, et al. As stated earlier, Rudd fails to teach or suggest modulating an electromagnetic signal with a modulating signal to provide an amplitude modulated signal prior to transmitting the signal to an object of interest, receiving a reflected amplitude modulated signal from the object, and demodulating the reflected amplitude modulated signal to extract vibration information, as set forth in each independent claim of Applicants' claimed invention. Kljuev, et al. fails to cure the deficiencies of Rudd, and is also absent any teaching, suggestion, or motivation to amplitude modulate a signal prior to transmission of an object, receiving reflected amplitude modulated signals from the object, and demodulating the amplitude modulated signals to extract vibration information. Indeed,

Kljuev, et al. merely discloses a device for measuring vibrations that comprises a microwave generator that transmits microwaves through a parabolic antenna to an object. Absolutely no mention is made of amplitude modulating a signal prior to transmission of the signal to an object, nor is any mention made of receiving a reflected amplitude modulated signal from an object and demodulating the reflected amplitude modulated signal. As such, Applicants submit that claims 3-6 are patentable over Rudd in view of Kljuev, et al.

Applicants submit that claim 8, which depends from independent claim 1 and contain all of the limitations thereof, is patentable over Rudd in view of Flock, et al. Rudd, discussed earlier, fails to teach or suggest modulating a signal to provide an amplitude modulated signal prior to transmission of the signal to an object and receiving and demodulating reflected amplitude modulated signals. Flock, et al. is also absent such teaching, suggestion, or motivation, and fails to cure the deficiencies of Rudd. Flock, et al. discloses a vibrometer that uses a laser diode to send a signal to an anatomical structure using coupling optics, and measures a speckle interference pattern reflected anatomical structure. As such, Flock, et al. is wholly devoid of an teaching, suggestion, or motivation to amplitude modulate a signal prior to transmitting the signal to an object of interest and receive and demodulate reflected amplitude modulated signals. Therefore, neither Rudd nor Flock, et al., taken alone or in combination, teach or suggest each element of Applicants' claimed invention as set forth in claim 8.

Applicants have amended independent claims 11 and 21 to further highlight the modulation and demodulation scheme of the present invention. More particularly, these claims now recite the feature of "demodulating the reflected amplitude modulated signal **using the modulating signal** to produce a demodulated signal." Neither Rudd, Russell, et al., Lewis, et al., Kljuev, et al., Flock, et al., nor Wang, et al., taken alone or in combination, teach or suggest such a feature. The system disclosed by Rudd is an interferometer, which mixes a probe signal with the returning reflected signal to produce an interference pattern from which the modulation signal is extracted. The present invention as claimed in independent claims 11 and 21 does not mix the probe signal with the returning reflected signal. Rather, the original **modulation signal**, not the probe signal, is used to de-modulate the returned reflected signal.

Likewise, none of remaining references teach or suggest using the original **modulation signal** to demodulate the returned reflected signal. In each of these references, the reflected signal is mixed with the probe signal, or not mixed with any signal at all. Therefore, neither Rudd, Russell, et al., Lewis, et al., Kljuev, et al., Flock, et al., nor Wang, et al., taken alone or in any combination, teach or suggest each element of Applicants' claimed invention as set forth in independent claims 11 and 21, and claims 12-20, 22, 24-31, 45, and 46 depending therefrom.

Applicants have also amended independent claim 32 to further highlight the feature of the present invention of compensating for unwanted vibrations. More particularly, this claim now recites the step of "compensating for unwanted vibration using a **second receiver** mounted with the first receiver." Neither Rudd, Russell, et al., Lewis, et al., Kljuev, et al., Flock, et al., nor Wang, et al., taken alone or in combination, teach or suggest such a feature. All of the cited references teach having a single receiver. There are no second receivers in any of the cited references. Nor do any of the cited references teach a technique for compensating for unwanted coupled or background vibration.

The Office Action asserts, incorrectly, that Rudd teaches a second receiver for compensating for unwanted coupled or background vibration. More particularly, the Office Action states, incorrectly, that the photodiode 36 of the photodetector assembly 32 disclosed in Rudd is the second receiver. In point of fact, the photodiode 36 is merely a single photodetector which receives reflected light for the entire photodetector assembly 32. There is no other device for receiving light, nor is there any device which compensates for unwanted vibrations. Thus, Rudd discloses only **one** receiver. Likewise, neither Russell, et al., Lewis, et al., Kljuev, et al., Flock, et al., nor Wang, et al. teach a second receiver for compensating for unwanted coupled or background vibration. Rather, in each of these references, there is only one receiver. Therefore, neither Rudd, Russell, et al., Lewis, et al., Kljuev, et al., Flock, et al., Wang, et al., taken

alone or in any combination, teach or suggest each element of Applicants' claimed invention as set forth in independent claim 32, and claims 33, 35-40, 43, and 47 depending therefrom.

Applicants have added independent claim 48 to further define the present invention. Claim 48 recites the steps of "providing a **non-coherent beam of light**; ... amplitude modulating the **non-coherent beam of light** with an amplitude modulating signal to produce an amplitude modulated beam of light; and .... demodulating the reflected amplitude modulated beam of light using **the amplitude modulating signal** to extract vibration information from the amplitude modulated signal." None of the cited references teach or suggest such features. Rather, all of the cited references employ **coherent** beams of light originating from lasers or laser diodes. As such, the cited references are concerned with using coherent sources of light. Therefore, none of the cited references above, taken alone or in combination, teach or suggest each element of Applicants' claimed invention as set forth in independent claim 48 and claims 49-53 depending therefrom.

Applicant has also added new independent claim 54 to further define the present invention. Claim 54 recites the steps of "a signal generator for generating a first **microwave** frequency signal; a power splitter for splitting the first **microwave** signal into a reference signal and a signal to be transmitted; a first mixer for mixing the phase

modulated reflected signal with an **intermediate frequency signal** to produce a first mixed signal; a second mixer for mixing the reference signal with the **intermediate frequency signal** to produce a second mixed signal; and ... an I & Q demodulator for mixing the first mixed signal and the second mixed signal to produce a demodulated signal." None of the cited references teach or suggest such features. Rather, all of the cited references except for Kljuev, et al. teach operation in the optical (visible) spectrum of the electromagnetic frequency range, and would be inoperable using microwave frequency signals. Kljuev, et al., as well as the other cited references, are absent any teaching, suggestion, or motivation to mix the phase modulated reflected signal with an intermediate frequency signal; mix the reference signal with the intermediate frequency signal; and then mix both of the resulting signals with each other to obtain a demodulated signal. Therefore, none of the cited references above, taken alone or in combination, teach or suggest each element of Applicants' claimed invention as set forth in independent claim 54.

All issues raised in the Office Action are believed to have been addressed. In view of the foregoing amendments and remarks, Applicants respectfully request reexamination and allowance of Claims 1-22, 23-33, 35-40, and 43-54. No new matter is believed to have been added. If such action cannot be taken, then the Examiner is invited to contact the Applicants' attorney at the telephone number set forth below to discuss the matter without the issuance of a further Office Action.

Respectfully submitted,

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Michael R. Friscia
Reg. No. 33,884
Attorney for Applicant
McCarter & English, LLP
Four Gateway Center
100 Mulberry Street
Newark, NJ 07102
Tel: (973) 639-8493
Fax: (973) 297-6627